

Association between aryl hydrocarbon receptor and 4-hydroxynonenal in oxidative stress-mediated chronic rhinosinusitis with nasal polyps

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Background: Chronic rhinosinusitis with nasal polyps (CRSwNPs) is a distinct entity within the chronic rhinosinusitis group of diseases, which are chronic upper airway diseases with several pheno- and endotypes. Oxidative stress plays an important role in the pathogenesis of CRSwNPs.

Aim: The aim was to assess the association between the expression of the aryl hydrocarbon receptor (AhR) and 4-hydroxynonenal (4-HNE) in patients with CRSwNPs.

Methods: The study included 26 patients who underwent endoscopic sinus surgery – 14 patients with CRSwNPs, and 12 controls with healthy sinus mucosa. The expression of AhR and 4-HNE was assessed in tissue samples using immunohistochemistry. The level of 4-HNE in serum samples was measured using the ELISA assay. The total oxidative capacity (TOC) was assessed by measuring the peroxidase activity.

Results: Higher levels of 4-HNE expression were observed in tissues (3, range 1-3 vs. 0, range 0-0, $p < 0.001$) and serum (27.7 ± 11.5 vs. 9.8 ± 7.7 pmol/mg, $p < 0.001$) samples of CRSwNPs patients, as compared to healthy controls. A higher expression of AhR was found in inflammatory cells (plasma cells, lymphocytes, eosinophiles) of CRSwNPs patients, compared to controls (3, range 1-3 vs. 2, range 1-2, $p = 0.001$). There were no differences in TOC across groups (0.0285 ± 0.0207 vs. 0.02978 ± 0.0197 $\mu\text{M H}_2\text{O}_2$ eq., $p = 0.848$). Patients with bronchial asthma (57%) had abundant eosinophiles in tissue samples. Patients with recalcitrant CRSwNPs had higher 4-HNE serum levels, compared to non-recalcitrant cases (27.3 vs. 24.2 pmol/mg, $p = 0.339$).

Conclusion: Patients suffering from CRSwNPs have oxidative stress mediated overexpression of AhR, which is linked to a chronic inflammatory response in the paranasal sinus tissues.

Keywords: chronic rhinosinusitis, nasal polyps, oxidative stress